probably owing to its relative weakness in comparison with the red one, could not be observed. Green and blue lines of other elements were also noticed, among which the most frequently conspicuous one, next to the yellow sodium-line, was, again, the green line of magnesium.

On August 13, 1879, the nucleus of an emerald-green bolide, as bright as Jupiter, produced a splendid continuous spectrum from red to violet, exhibiting first a bright sodium-line, and immediately afterwards the green magnesium-line also, and some others, supposed to be those of copper, with two faint red lines. A similar bolide on August 9, 1880, showed on the continuous spectrum of its nucleus, besides the sodium-line very bright, those of lithium distinctly, and many metallic lines in the green and blue portions of the spectrum.

This occurrence of carbon, magnesium, and other spectral lines (possibly of iron) in the vapour-streaks of shooting-stars and fireballs, establishes a more certain and unequivocal resemblance between their chemical compositions and those of solid meteorites, than does the exhibition of the sodium-line, which, as Herr von Konkoly observes, may possibly be due to the original presence of saline particles in the air itself. But its extreme brightness in some, and total absence in other meteor-streaks, seems yet rather difficult to account for on that supposition. On the other hand the detection of carbon, while it agrees with the element's occurrence in siderites and carbonaceous aërolites, reminds us also of the abundant proofs which Dr. Huggins and other spectroscopic observers have obtained of the same element's prevalence in comets. And indeed the prolonged luminosity of meteor-streaks, with their complex gaseous spectra proceeding for long courses of time from an exceedingly attenuated atmosphere, is itself a physical riddle whose explanation as a mere question of radiation can scarcely be very different from what is demanded by the phenomenon of self-luminosity in the known gaseous nebulæ and in the envelopes of comets.

Of Dr. Huggins' applications of sidereal spectroscopy to neubulæ and comets, it may be mentioned that the extremely eventful discoveries are not individually named and noticed among the many high encomiums rightly bestowed upon that refined use of the spectroscope, in the opening address. But the results therefrom obtained were yet fully as revolutionising as regards the prevailing theories of those bodies, and of the general plan of construction of the sidereal heavens, as some of the spectroscopic discoveries described in the fifty-years' retrospect were (as is there lucidly related) thoroughly subversive of the formerly existing views of the internal physical condition of the sun.

If I have here ventured to disown, and to disclaim for myself some of the major accomplishments of meteor-spectroscopy by showing them to be the results of later, independent, and much more perfect observations, it is because, in comparison with the very significant amplification which those later observations have effected in the subject, the easy recognition of the presence of sodium in meteor-streaks can only claim to be regarded as a slight and inconsiderable first-adventure in a province of spectrum analysis, the additions and improvements subsequently made in which have been attended with much more remarkable success.

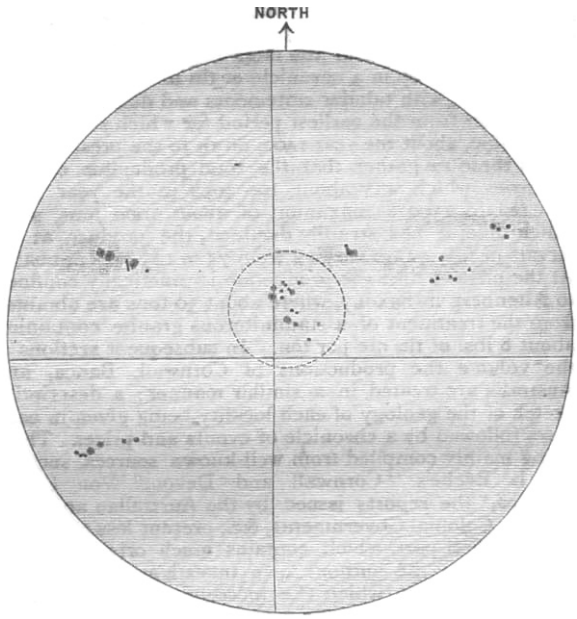
In the wide and accurate survey of the admirable opening discourse, which strays with truly lifelike fidelity over all the broad domains, the well-won fields and gallantly-scaled citadels of modern scientific knowledge, I shall, I trust, be pardoned if, in a matter of very little estimation by itself, I thus attempt to remove and banish from the eulogies of the address a small and unobtrusive and apparently unconscious excrescence of the otherwise harmless and innocent transgression, *magnis componere parva*.

A. S. HERSCHEL

Collingwood, September 12

Sun-Spots

RECORDS concerning phenomena are considerably enhanced in value if they include accurate determinations of the *times* of occurrence. This appears specially applicable to solar phenomena, and particularly to sun-spots, of which there must be many thousands of exact delineations without precise record of the times when the spots first appeared on the visible surface of the sun. No doubt there are several reasons to account for this unavoidable absence of valuable information; amongst others the intense brightness and heat of the sun make it an exceedingly disagreeable object for protracted telescopic inspection; nor yet are we in a position at present to photograph it continuously, so that we are necessarily content to compare photographs taken at intervals of perhaps many hours, and to assume, or at any rate not to dispute, that events of great importance have not occurred in the intervals. This is the more to be regretted because a knowledge of solar events is comparatively of little importance unless it helps us to ascertain what influence those events exercise on the earth and its inhabitants; and it is obvious that in comparing solar and terrestrial phenomena the times of occurrences are of essential importance, if only to avoid ascribing an undue effect to a given cause. It thus follows that even an approximate time of the appearance of sun-spots is not without value. On these grounds, as well as on the score of magnitude, I communicate the following particulars of a recent appearance, or outburst, of sun-spots, which occurred within certain moderate limits of time. I premise briefly that a photoheliograph is in daily use at the Trigonometrical Survey Office, Dehra Doon, India, of which I have executive charge. At present the instrument yields but a 4-inch negative, which is merely a microscopic delineation of 1¼ million millions square miles of solar surface; however, as surely



Tracing from sun negative taken at Dehra Observatory, Great Trigonometrical Survey of India. Latitude 30° 19′ 29″ N.; Longitude 78° 5′ 42″ E. Height above sea 2232 feet, on July 25, 1881, at 4.47 p.m. local apparent time. Spots visible in previous negative taken on the same day at 3.58 p.m. are coloured black; and the new spots which appeared between 4 and 5 p.m. are surrounded by a dotted circle.

as the sun shines, so surely are at least two negatives taken of it daily. Interruptions, even in a land of sunshine like this, sometimes occur; notably at the bursting of the monsoons, which occurred here last month (July), when the photographer was compelled to take the sun whenever visible, rather than not take him at all. Under this choice of alternations the first negative (or say N_1) on July 25, 1881, was taken at 3.58 p.m. of local apparent time; it exhibited several sun-spots, as is now usual, and of which therefore little need be said, since solar observers are well aware that the sun has for some months past resumed a state of considerable energy in respect to development of features; the second negative, or N_2, was taken at 4.47 p.m. On comparing N_1 and N_2 it was at once seen that in the interval of 49m. a considerable group of spots had appeared in the neighbourhood of the sun's centre. It is exceedingly difficult to exhibit an exact delineation of spots when the negative is on so minute a scale; I however inclose a silver print, as well as a hand-tracing of N_2, from which the position and magnitude of the group, *i.e.* the new group, may be nearly inferred. This new group consists of sixteen spots, of which no individual spot is notably large, but there is this peculiarity about them all, that they exhibit hardly any penumbra, but consist almost entirely of well-defined umbra; what penumbra appears, is

confined chiefly to two spots, where it is seen only to the south-east; imagine a round, straight hole bored through a stratum of sand sufficiently adhesive for the sides to remain erect for a time, and after this suppose that the sand begins to fall inwards, creating a partial cone around to the south-east side; this is the sort of progress that these two spots convey. As to magnitude, the spots are scattered over an area of some 6000 millions of square miles; while the collective area of the spots themselves is about 630 millions of square miles, or, say, six times the area presented by the earth to the sun. Remembering that of solar change "a little goes a long way," so far as we are concerned, who shall say that changes of this magnitude are inappreciable on the earth, however ineffectual the instruments we can now command may be able to measure them? But was this sudden change inappreciable? that is now the question. Unhappily the sun remained invisible till July 30, when two negatives were taken, *i.e.* after an interval of just five days; so far as solar rotation could effect, the so-called new group of N_2 should have been visible not far from the sun's western edge; but the entire group had vanished, leaving no trace behind. In the interim of five days two new spots had come out; of *one* of these I may add that the umbra is about 200 millions of square miles, and the penumbra some 700 millions, presenting in all a single feature of more than 900 millions of square miles, or say nine times the area exhibited by the earth to a distant spectator. This ends the purport of my letter. But I cannot help adding that I believe the bright solar features or faculæ will eventually prove to be more effective exponents than the dark features or spots; as a matter of fact, faculæ commonly appear in abundance, covering considerable areas and branching out from one another like coral reefs; and it is a mistake to suppose that faculæ exist only in the vicinity of spots; the former may abound where the latter are quite absent, not only in a 4-inch negative, but in a very fair 5-inch equatorial. But I suppose the world will be better informed some day. Meanwhile, surely the sun is worthy of more earnest attention, not only from points of attack already so ably occupied, but from others none the less important, though at present greatly neglected: need I name solar radiation and photography? Physicians are alarmed for the safety of our bodies on detection of even a trifling change in temperature; but what do we know of fluctuations in the source of all terrestrial heat, though it be measurable with an actinometer? Again, land surveys are often made on huge scales; but for the solar survey of 1¼ million millions of square miles, what is our largest delineation, and at how many spots round the world is the required daily record made? If a survey of London pays, depend on it surveys of the sun will pay all nations infinitely better.

J. B. N. HENNESSEY

India, North-West Provinces, Mussooree, August 5

Proneomenia sluiteri, Hubrecht

IN the report of the Proceedings of the Biological Section of the British Association which appeared in NATURE, vol. xxiv. p. 501, there is a slight mistake in the notice of my friend Dr. Hubrecht's paper on *Proneomenia*. This interesting mollusc is erroneously described as "one of the valuable finds of the *Challenger* Expedition." So far as I am aware, neither *Proneomenia* nor either of the other two genera of the *Solenogastres* (*Neomenia*, *Chætoderma*) was obtained by the *Challenger*. The only two specimens of *Proneomenia* which are known to science as yet were dredged by the Dutch Arctic Expedition of 1878 (or 1879), at depths of 110 and 160 fathoms in the Barents Sea. It was not obtained by the *Wilhelm Barents* in 1880, but we may hope that the dredgings of this season have been more productive, for Dr. Hubrecht informs me that 1881 has been a very bad ice year, and that the *Wilhelm Barents* has not succeeded in penetrating so far north as she has done in previous years. The summer has therefore been devoted to dredging operations, and valuable results may be expected. The zoological results of the Dutch Arctic Expeditions of 1878 and 1879 are being published as supplemental volumes of the *Niederländische Archiv für Zoologie*; and in the second of these, which is now in course of publication, will be found an elaborate memoir by Dr. Hubrecht entitled "*Proneomenia sluiteri*, gen. et sp.n., with Remarks upon the Anatomy and Histology of the Amphineura."

Eton College, September 24 P. HERBERT CARPENTER

Polydonia frondosa

THE Medusa mentioned by Mr. Archer in NATURE, vol. xxiv. p. 307, is undoubtedly *Polydonia frondosa*, Ag., figured in the Contributions to the Natural History of the United States. This Medusa was already known to Pallas, who described alcoholic specimens sent him from the West Indies by Drury. It is stated by Agassiz to be quite common along the Florida Keys. I have myself observed it in great abundance at the Tortugas, in the moat of Fort Jefferson, and in the mud flats to the north of Key West. They occur there in from three to six feet of water, the disk resting upon the bottom, the tentacles turned upwards; the disk pulsates slowly while they are at rest. Their habits when disturbed are well described by Mr. Archer. The young sometimes swim near the surface, and are far more active than larger specimens. When kept in confinement they also creep slowly over the ground by means of their tentacles, or, raising themselves sometimes edgeways against the sides of the dishes, remain stationary for a considerable time. The resemblance of Polydonia when at rest upon the bottom to large Actiniæ with fringed tentacular lobes, such as Phythactis, is very striking. The peculiar habits of Polydonia were noticed by Mertens in a species named by Brandt *P. Mertensii* in 1838; and found at the Carolines. The genus Polydonia was established by Brandt, and not by Agassiz, as is stated by Haeckel in his "System der Medusen." ALEXANDER AGASSIZ

Cambridge, Mass., August 27

Constancy of Insects in Visiting Flowers

MR. A. W. BENNETT'S paper (NATURE, vol. xxiv. p. 501) on the "Constancy of Insects in Visiting Flowers" recalls a note I made at Cromer during the hot weather of last July. On the cliffs west of that town, where flowers were very abundant and of various colours, I carefully watched the movements of a small tortoiseshell butterfly to ascertain what flowers it visited. It was at first busy with bindweed; then it left this for yellow bedstraw (*Galium verum*), returning presently to bindweed. Then it tried a thistle, which detained it some time, after which it shifted to ragwort, and finally revisited bindweed. It seemed equally busy with all these flowers, though so various in form and colour. My tortoiseshell was therefore less constant than Mr. Bennett's, and its visits were successive, there being no interludes on grass, leaf, tree-trunk, or ground.

Homerton College, E. J. T. POWELL

[In Mr. Bennett's paper, p. 501, col. 2, line 31 from bottom, for *from* read *more*.]

Brewing in Japan

WILL you permit me to point out an error which has crept into the report of my paper on "Brewing in Japan" in last week's NATURE, p. 468. After mentioning the points in which *Kōji* differs from malt, the report continues:—"Kōji is prepared as follows: a mixture of steamed rice and water is allowed to remain in shallow tubs at a low temperature (0°–5° C.) until quite liquid; it is then heated," and so on. The following alterations will make the account of the Japanese brewing process correct:—"*Saké* (rice-beer) is prepared as follows: a mixture of steamed rice, *kōji*, and water is allowed to remain in shallow tubs at a low temperature (0° – 5° C.) until quite liquid; it is then heated . . . ". Not using malt as we do in our breweries, the Japanese have discovered for themselves a means of rendering the rice-grains diastatic with allowing the embryo to germinate. This is effected by exposing the softened rice-grains to the action of dry steam, by which treatment the starch is gelatinised; when cold the spores of a mould are caused to grow over the surface of the rice, the mycelium being formed at the expense of the starch, and heat being liberated together with the usual products of combustion. The albuminoid matter of the rice, which previously was for the most part insoluble in water, is, after the growth of the mycelium, found to be almost completely soluble, and the solution possesses diastatic properties resembling those of malt extract. The main point in which it differs from the latter is in its superior hydrating power, for, unlike malt-extract, the solution of *kōji* very quickly converts maltose into dextrose. This material (kōji) is then used instead of malt in the mashing process, the sugar formed from the rice-starch under the influence of the dissolved kōji being dextrose, which is further fermented by the accidental introduction from the atmosphere of the germs of a species of yeast. The change induced in the character of the albuminoid matter under the influence of the growing mould is remarkable, and, I think, novel, and the interest of the observations I have made lies in